Chapter 3

A History of Instructional Design and Technology

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As was indicated in the first chapter of this book, over the years, two practices—the use of systematic instructional design procedures (often simply called *instructional design*) and the use of media for instructional purposes—have formed the core of the field of instructional design and technology. This chapter will review the history of the field by examining the history of instructional media and the history of instructional design. From a historical perspective, most of the practices related to instructional media have occurred independent of developments associated with instructional design. Therefore the history of each of these two sets of practices will be described separately. It should also be noted that although many important events in the history of the field of instructional design and technology have taken place in other countries, the emphasis in this chapter will be on events that have taken place in the United States.

History of Instructional Media

The term *instructional media* has been defined as the physical means via which instruction is presented to learners (Reiser & Gagné, 1983). Under this definition, every physical means of instructional delivery, from the live instructor to the textbook to the computer and so on, would be classified as an instructional medium. It may be wise for practitioners in the field to adopt this viewpoint; however, in most discussions of the history of instructional media, the three primary means of instruction prior to the twentieth century (and still the most common means today)—the teacher, the chalkboard, and the textbook—have been categorized separately from other media (cf. Commission on Instructional Technology, 1970). In order to clearly describe the history of media, this viewpoint will be employed in this chapter. Thus, instructional media will be defined as the physical means, other than the teacher, chalkboard, and textbook, via which instruction is presented to learners.

School Museums

In the United States, the use of media for instructional purposes has been traced back to at least as early as the first decade of the twentieth century (Saettler, 1990). It was at that time that school museums came into existence. As Saettler (1968) has indicated, these museums "served as the central administrative unit[s] for visual instruction by [their] distribution of portable museum exhibits, stereographs [three-dimensional photographs], slides, films, study prints, charts, and other instructional materials" (p. 89). The first school museum was opened

[1]Portions of this chapter previously appeared as a book chapter (Reiser, 1987).

in St. Louis in 1905, and shortly thereafter school museums were opened in Reading, Pennsylvania, and Cleveland, Ohio. Although few such museums have been established since the early 1900s, the district-wide media center can be considered a modern equivalent.

Saettler (1990) has also stated that the materials housed in school museums were viewed as supplementary curriculum materials. They were not intended to supplant the teacher or the textbook. Throughout the past one hundred years, this early view of the role of instructional media has remained prevalent in the educational community at large. That is, during this time period most educators have viewed instructional media as supplementary means of presenting instruction. In contrast, teachers and textbooks are generally viewed as the primary means of presenting instruction, and teachers are usually given the authority to decide what other instructional media they will employ. Over the years, a number of professionals in the field of instructional design and technology (e.g., Heinich, 1970) have argued against this notion, indicating that (a) teachers should be viewed on an equal footing with instructional media—as just one of many possible means of presenting instruction; and (b) teachers should not be given sole authority for deciding what instructional media will be employed in classrooms. However, in the broad educational community, these viewpoints have not prevailed.

The Visual Instruction Movement and Instructional Films

As Saettler (1990) has indicated, in the early part of the twentieth century, most of the media housed in school museums were visual media, such as films, slides, and photographs. Thus, at the time, the increasing interest in using media in the school was referred to as the "visual instruction" or "visual education" movement. The latter term was used at least as far back as 1908, when the Keystone View Company published *Visual Education,* a teacher's guide to lantern slides and stereographs.

Besides magic lanterns (lantern slide projectors) and stereopticons (stereograph viewers), which were used in some schools during the second half of the nineteenth century (Anderson, 1962), the motion picture projector was one of the first media devices used in schools. In the United States, the first catalog of instructional films was published in 1910. Later that year, the public school system of Rochester, New York, became the first to adopt films for regular instructional use. In 1913, Thomas Edison proclaimed: "Books will soon be obsolete in the schools. . . . It is possible to teach every branch of human knowledge with the motion picture. Our school system will be completely changed in the next ten years" (cited in Saettler, 1968, p. 98).

Durning the ten-year period Edison was referring to (1914–1923), the visual instruction movement did grow. Five national professional organizations for visual instruction were established, five journals focusing on visual instruction began publication, more than twenty teacher-training institutions began offering courses in visual instruction, and at least a dozen large-city school systems developed bureaus of visual education (Saettler, 1990). However, by the end of that ten-year period, the revoluntary changes in education envisoned by that Edison had not come about. Cuban (1986) indicates that the impact of the visual instruction was limited because of a wide variety of factors, including teacher resistance to change, the difficultly teachers had in operating film equipment, the paucity and poor instructional quality of relevant films in many subject areas, and the costs associated with purchasing and maintaining films and equipment.

The Audiovisual Instruction Movement and Instructional Radio

During the remainder of the 1920s and through much of the 1930s, technological advances in such areas as radio broadcasting, sound recordings, and sound motion pictures led to increased interest in instructional media. With the advent of media incorporating sound, the visual instruction movement became known as the audiovisual instruction movement (Finn, 1972; McCluskey, 1981). However, McCluskey (1981), who was one of the leaders in the field during this period, indicates that while the field continued to grow, the educational community at large was not greatly affected by that growth. He states that by 1930, commercial interests in the visual instruction movement had invested and lost more than $50 million, only part of which was due to the Great Depression, which began in 1929.

In spite of the adverse economic effects of the Great Depression, the audiovisual instruction movement continued to evolve. According to Saettler (1990), one of the most significant events in this evolution was the merging, in 1932, of the three existing national professional organizations for visual instruction. As a result of this merger, leadership in the movement was consolidated within one organization, the Department of Visual Instruction (DVI), which at that time was part of the National Education Association. Over the years, this organization, which was created in 1923, and which is now called the Association for Educational Communications and Technology (AECT), has maintained a leadership role in the field of instructional design and technology.

During the 1920s and 1930s, a number of textbooks on the topic of visual instruction were written. Perhaps the most important of these textbooks was *Visualizing the*

Curriculum, written by Charles F. Hoban, Sr., Charles F. Hoban, Jr., and Stanley B. Zissman (1937). In this book, the authors stated that the value of audiovisual material was a function of their degree of realism. The authors also presented a hierarchy of media, ranging from those that could only present concepts in an abstract fashion to those that allowed for very concrete representations (Heinich, Molenda, Russell, & Smaldino, 1999). Some of these ideas had previously been discussed by others, but had not been dealt with as thoroughly. In 1946, Edgar Dale further elaborated on these ideas when he developed his famous "Cone of Experience." Throughout the history of the audiovisual instruction movement, many have indicated that part of the value of audiovisual materials is their ability to present concepts in a concrete manner (Saettler, 1990).

A medium that gained a great deal of attention during this period was radio. By the early 1930s, many audiovisual enthusiasts were hailing radio as the medium that would revolutionize education. For example, in referring to the instructional potential of radio, films, and television, the editor of publications for the National Education Association stated that "tomorrow they will be as common as the book and powerful in their effect on learning and teaching" (Morgan, 1932, p. ix). However, contrary to these sorts of predictions, over the next twenty years, radio had very little impact on instructional practices. Cuban (1986) indicates that poor equipment, poor reception of radio signals, scheduling problems and teacher resistance to change were among the many factors that resulted in this lack of impact.

World War II

With the onset of World War II, the growth of the audiovisual instruction movement in the schools slowed; however, audiovisual devices were used extensively in the military services and in industry. For example, during the war the U.S. Army Air Force produced more than 400 training films and 600 filmstrips and during a two-year period (from mid-1943 to mid-1945) it was estimated that there were over 4 million showings of training films to U.S. military personnel. Although there was little time and opportunity to collect hard data regarding the effect of these films on the performance of military personnel, several surveys of military instructors revealed that they felt that the training films and filmstrips used during the war were effective training tools (Saettler, 1990). Apparently, at least some of the enemy agreed; in 1945, after the war ended, the German Chief of General Staff said: "We had everything calculated perfectly except the speed with which America was able to train its people. Our major miscalculation was in underestimating their quick and complete mastery of film education" (cited in Olsen & Bass, 1982, p. 33).

During the war, training films also played an important role in preparing civilians in the United States to work in industry. In 1941, the federal government established the Division of Visual Aids for War Training. From 1941 to 1945, this organization oversaw the production of 457 training films. Most training directors reported that the films reduced training time without having a negative impact on training effectiveness, and that the films were more interesting and resulted in less absenteeism than traditional training programs (Saettler, 1990).

In addition to training films and film projectors, a wide variety of other audiovisual materials and equipment were employed in the military forces and in industry during World War II. Those devices that were used extensively included overhead projectors, which were first produced during the war; slide projectors, which were used in teaching aircraft and ship recognition; audio equipment, which was used in teaching foreign languages; and simulators and training devices, which were employed in flight training (Olsen & Bass, 1982; Saettler, 1990).

Theories of Communication

During the decade after World War II, many leaders in the audiovisual instruction movement became interested in various theories or models of communication, such as the model put forth by Shannon and Weaver (1949). These models focused on the communication process, a process involving a sender and a receiver of a message, and a channel, or medium, through which that message is sent. The authors of these models indicated that during planning for communication it was necessary to consider all the elements of the communication process, and not just focus on the medium, as many in the audiovisual field tended to do. As Berlo (1963) stated: "As a communication man I must argue strongly that it is the process that is central and that the media, though important, are secondary" (p. 378). Several leaders in the audiovisual movement, such as Dale (1953) and Finn (1954), also emphasized the importance of the communication process. Although at first, audiovisual practitioners were not greatly influenced by this notion (Lumsdaine, 1964; Meierhenry, 1980), the expression of this point of view eventually helped expand the focus of the audiovisual movement (Ely, 1963, 1970; Silber, 1981).

Instructional Television

Perhaps the most important factor to affect the audiovisual movement in the 1950s was the increased interest in television as a medium for delivering instruction. Prior to the 1950s, there had been a number of instances in which television had been used for instructional purposes (Gumpert, 1967; Taylor, 1967). During the 1950s, however, there was a tremendous growth in the use of

instructional television. This growth was stimulated by at least two major factors.

One factor that spurred the growth of instructional television was the 1952 decision by the Federal Communications Commission to set aside 242 television channels for educational purposes. This decision led to the rapid development of a large number of public (then called "educational") television stations. By 1955, there were seventeen such stations in the United States, and by 1960 that number had increased to more than fifty (Blakely, 1979). One of the primary missions of these stations was the presentation of instructional programs. As Hezel (1980) indicates: "The teaching role has been ascribed to public broadcasting since its origins. Especially prior to the 1960s, educational broadcasting was seen as a quick, efficient, inexpensive means of satisfying the nation's instructional needs" (p. 173).

The growth of instructional television during the 1950s was also stimulated by funding provided by the Ford Foundation. It has been estimated that during the 1950s and 1960s the foundation and its agencies spent more than $170 million on educational television (Gordon, 1970). Those projects sponsored by the foundation included a closed-circuit television system that was used to deliver instruction in all major subject areas at all grade levels throughout the school system in Washington County (Hagerstown), Maryland; a junior-college curriculum which was presented via public television in Chicago; a large-scale experimental research program designed to assess the effectiveness of a series of college courses taught via closed circuit television at Pennsylvania State University; and the Midwest Program on Airborne Television Instruction, a program designed to simultaneously transmit televised lessons from an airplane to schools in six states.

By the mid-1960s, much of the interest in using television for instructional purposes had abated. Many of the instructional television projects developed during this period had short lives. For example, by 1963 the Ford Foundation decided to focus its support on public television in general, rather than on in-school applications of instructional television (Blakely, 1979). In addition, many school districts discontinued instructional television demonstration projects when the external funding for those projects was halted (Tyler, 1975b). Moreover, instructional programming was still an important part of the mission of public television, but that mission was now wider, encompassing other types of programming, such as cultural and informational presentations (Hezel, 1980). In light of these and other developments, in 1967 the Carnegie Commission on Educational Television concluded:

> The role played in formal education by instructional television has been on the whole a small one . . . nothing which approached the true potential of instructional television has been realized in practice. . . . With minor exceptions, the total disappearance of instructional television would leave the educational system fundamentally unchanged. (pp. 80–81)

Many reasons have been given as to why instructional television was not adopted to a greater extent. These include teacher resistance to change, especially *top-down change* (change mandated by school adminstrators with little or no input from teachers), the mediocre instructional quality of many of the television programs (many of them did little more than present a teacher delivering a lecture), the expense of installing and maintaining television systems in schools, and the failure to provide teachers with adequate guidance as to how to integrate the use of instructional television into their instructional practices (Chu & Schramm, 1975; Cuban, 1986; Gordon, 1970; Tyler, 1975b).

Using Computers for Instructional Purposes

After the interest in instructional television faded, the next technological innovation to catch the attention of a large number of educators was the computer. Although widespread interest in the computer as an instructional tool did not occur until the 1980s, computers were first used in education and training at a much earlier date. Much of the early work in computer-assisted instruction (CAI) was done in the 1950s by researchers at IBM, who developed the first CAI author language and designed one of the first CAI programs to be used in the public schools. Other pioneers in this area included Gordon Pask, whose adaptive teaching machines made use of computer technology (Lewis & Pask, 1965; Pask, 1960; Stolorow & Davis, 1965), and Richard Atkinson and Patrick Suppes, whose work during the 1960s led to some of the earliest applications of CAI at both the public school and university levels (Atkinson & Hansen, 1966; Suppes & Macken, 1978). Other major efforts during the 1960s and early 1970s included the development of CAI systems such as PLATO and TICCIT. However, in spite of the work that had been done, by the end of the 1970s, CAI had had very little impact on education (Pagliaro, 1983).

By the early 1980s, a few years after personal computers became available to the general public, the enthusiasm surrounding this tool led to increasing interest in using computers for instructional purposes. By January 1983, computers were being used for instructional purposes in more than 40 percent of all elementary schools and more than 75 percent of all secondary schools in the United States (Center for Social Organization of Schools, 1983).

Many educators became attracted to personal computers as an instructional tool because they were relatively

inexpensive, were compact enough for desktop use, and could perform many of the functions performed by the large computers that had preceded them. As was the case when other new media were first introduced into the instructional arena, many expected that this medium would have a major impact on instructional practices. For example, in 1984, Papert indicated that the computer was going to be "a catalyst of very deep and radical change in the educational system" (p. 422) and that by 1990 one computer per child would be a very common state of affairs in schools in the United States.

At first, optimistic predictons about the extent to which computers would transform instructional practices appeared to be wrong. By the mid-1990s that impact had been rather small. Surveys revealed that by 1995, although schools in the United States possessed, on average, one computer for every nine students, the impact of computers on instructional practices was minimal, with a substantial number of teachers reporting little or no use of computers for instructional purposes. Moreover, in most cases, the use of computers was far from innovative. In elementary schools, teachers reported that computers were being primarily used for drill and practice, and at the secondary level, reports indicated that computers were mainly used for teaching computer-related skills such as word processing (Anderson & Ronnkvist, 1999; Becker, 1998; Office of Technology Assessment, 1995). However, as discussed below, events during the first decade of the current century indicate that computers and other new technologies are having more of an impact on education and training than many of the media that preceded these innovations.

Recent Developments

During the past ten years, rapid advances in computers and other digital technology, including the Internet, have led to a rapidly increasing interest in, and use of, these media for instructional purposes. This conclusion appears to be true across a wide variety of training and educational settings, including businees and industry, higher education, K–12 education, and the military.

In buisness and industry, surveys reveal that during the past decade there has been a substantial increase in percentage of training that is presented via instructional media. A recent survey of over three hundred companies in the United States indicated that more than 30 percent of the total amount of training hours during 2008 was presented via technology, with more than 24 percent of that training delivered online (Amercian Society for Training & Development, 2009). In comparison, in 1999, less than 10 percent of the training in business and industry was presented via technology (American Society for Training & Development, 2004).

In higher education, the use of instructional technology, particularly newer media, has also been on the rise in recent years. For example, a 2010 survey revealed that over 50 percent of college faculty use social media for instructional purposes. Having students view online videos, listen to podcasts, and read and/or create blogs and wikis were the most common types of activities involving such media (Babson, 2010).

Recently, the use of distance learning in higher education has also grown dramatically, with the annual growth in online enrollments in higher education recently being more than ten times greater than the annual overall growth in the student population in higher education. In the fall 2008 term, more than 4.6 million students were taking online courses offered by higher education institutions in the United States, which represented a 17 percent increase in the number of students from the previous year (Allen & Seaman, 2010).

Online instruction is also becoming prevalent in K–12 settings. A recent report reveals that in the United States, forty-five of the fifty states have an online school initiative, with twenty-four of those states having statewide full-time online schools. Moreover, 57 percent of the public secondary schools in the United States provide students with access to online learning (International Association for K-12 Online Learning, 2009).

During the first decade of this century, the *availability* of technology in public schools in the United States has also increased significantly. For example, whereas in 1999 only 64 percent of classrooms had computers with Internet access, in 2009 Internet access was available in 93 percent of classroms (Gray, Thomas, & Lewis, 2010b; Snyder & Dillow, 2010). Morover, the instructional *utilization* of technology in the schools seems to have shifted considerably during the decade. Whereas earlier reports revealed that the instructional uses of computers often centered around drill and practice activities for students (SRI International, 2002), a 2009 survey revealed that many teachers were having their students use technology for a much wider array of instructional activities. For example, 24 percent of the teachers indicated that they frequently had their students use technology to conduct research, with another 42 percent indicating that they had their students do so occasionally. Morover, at least 25 percent of the teachers indicated that on a frequent or occasional basis they had their students use technology to solve problems, analyze data, perform calculations, develop mulitmedia presentations, and create art, music, movies, webcasts, graphics, or visual displays (Gray, Thomas, & Lewis, 2010a).

Currently, technology is also playing a major role in the delivery of instruction in the U.S. military, with much of that technology-based instruction being delivered online.

For example, the Army e-Learning program offers worldwide 24/7 access to more than 2600 courses to the entire Army workforce, including active-duty and reserve soldiers, cadets, and Army civilian personnel (Kring & Thomas, 2008). Another example of the pervasiveness of online learning in the military is the Joint Knowledge Online (JKO) system, which provides online joint forces training to personnel in all branches of the military. In its first two years of operations, JKO offered more than 330 courses, which were taken by more than 100,000 users (Camacho, 2009). Simulation and gaming technology now also plays a major role in military training, with virtual simulations and digital 3D games often being employed (Erwin, 2009; Fletcher, 2009).

Most of the evidence presented in this section of this chapter clearly indicates that in recent years there has been a significant increase in the use of instructional media in a variety of settings, ranging from business and industry to the military and higher education. What are some of the reasons for this increased usage? In business and industry and the military, the Internet has been viewed as a means of providing instruction and information to widely dispersed learners at a relatively low cost. Moreover, in many cases, the easy accessibility of computers makes it possible for learners to receive instruction and/or performance support when and where they need it, oftentimes as they are performing particular job tasks.

In higher education, distance education via the Internet has been seen as a low-cost method of providing instruction to students who, due to a variety of factors (e.g., job and family responsibilities, geographic factors), might not otherwise have been able to receive it. Moreover, institutions of higher education often view online courses as a significant source of additional revenue.

Another reason that the newer media are being used to a greater extent may be due to their increased interactive capabilities. Moore (1989) describes three types of interactions among the agents usually involved in an instructional activity. These interactions are between learners and instructional content, between learners and the instructor, and among learners themselves. Due to their attributes, the instructional media that were prevalent during some portion of the first two thirds of the past century (e.g., films and instructional television) were primarily employed as a means of having learners interact with instructional content. In contrast, through the use of such features as e-mail, chat rooms, and bulletin boards, the Internet is often used as a means of having learners interact with their instructor and with other learners, as well as with instructional content. This is one example of how some of the newer media make it easier to promote the various types of interactions described by Moore.

In addition, advances in computer technology, particularly with regard to the increasing multimedia capabilities of this medium, have made it easier for educators to design learning experiences that involve more complex interactions between learners and instructional content than has previously been the case. For example, as the amount and type of information (e.g., print, video, audio) that can be presented by computers has increased, the type of feedback, as well as the type of problems, that can be presented to learners has greatly expanded. These increased instructional capabilities have attracted the attention of many educators. Moreover, the ability of computers to present information in a wide variety of forms, as well as to allow learners to easily link to various content, has attracted the interest of instructional designers having a constructivist perspective. They and others who are particularly concerned with presenting authentic (i.e., "real-world") problems in learning environments in which learners have a great deal of control of the activities they engage in and the tools and resources they use, find the new digital technology more accommodating than its predecessors.

Finally, in recent years, technologies such as personal computers, mobile devices, and the Internet have become pervasive, and the use of the tools and technologies associated with social networking (e.g., Facebook and LinkedIn) and social media (e.g., blogs, wikis, YouTube, and Twitter) has become widespread. These tools and technologies have become commonplace devices for individuals to share information and acquire new skills and knowledge. In light of this fact, it is not surprising that educators are frequently turning to these devices as a means of supporting instruction, learning, and on-the-job performance.

Conclusions Regarding the History of Instructional Media

Of the many lessons we can learn by reviewing the history of instructional media, perhaps one of the most important involves a comparison between the anticipated and actual effects of media on instructional practices. As Cuban (1986) has pointed out, as you look back over the past century of media history, you are likely to note a recurrent pattern of expectations and outcomes. As a new medium enters the educational scene, there is a great deal of initial interest and much enthusiasm about the effects it is likely to have on instructional practices. However, enthusiasm and interest eventually fade, and an examination reveals that the medium has had a minimal impact on such practices. For example, Edison's optimistic prediction that films would revolutionize education proved to be incorrect, and the enthusiasm for instructional television that existed during the 1950s greatly abated by the mid-1960s, with little impact on instruction in the schools. Both of these examples involve the use of media in schools, the setting in which the use of instructional media has been most

closely examined. However, data regarding the use of instructional media in business and industry supports a similar conclusion; namely, that in spite of enthusiasm about the use of instructional media in business and industry, *until recently* media have had a minimal impact on instructional practices in that environment.

What about the predictions, first made in the 1980s, that computers would revolutionize instruction? As the previous section indicates, during the past ten years, computers and related technologies have been playing a larger and larger role in the instructional process, but they have not as yet brought about the instructional revolution that some envisioned. Will that revolution eventually come about? In light of the aforementioned reasons for the increasing use of the newer media, I think it is reasonable to predict that over the next three to five years, computers, the Internet, and other digital media, while not totally revolutionalizing education and training, will continue to bring about far greater changes in instructional practices than the media that preceded them.

History of Instructional Design

As mentioned earlier, in additon to being closely associated with instructional media, the field of instructional design and technology has also been closely associated with the use of systematic instructional design procedures. As was indicated in Chapter 2, a variety of sets of systematic instructional design procedures (or models) have been developed, and have been referred to by such terms as *the systems approach*, *instructional systems design* (*ISD*), *instructional development*, and *instructional design* (which is the term I will use in the remainder of this chapter). Although the specific combination of procedures often varies from one instructional design model to the next, most of the models include the analysis of instructional problems and the design, development, implementation, and evaluation of instruction procedures and materials intended to solve those problems. How did this instructional design process come into being? This portion of this chapter will focus on answering that question.

The Origins of Instructional Design: World War II

The origins of instructional design procedures have been traced to World War II (Dick, 1987). During the war, a large number of psychologists and educators who had training and experience in conducting experimental research were called upon to conduct research and develop training materials for the military services. These individuals, including Robert Gagne, Leslie Briggs, John Flanagan, and many others, exerted considerable influence on the characteristics of the training materials that were developed, basing much of their work upon instructional principles derived from research and theory on instruction, learning, and human behavior (Baker, 1973; Saettler, 1990).

Moreover, psychologists used their knowledge of evaluation and testing to help assess the skills of trainees and select the individuals who were most likely to benefit from particular training programs. For example, at one point in the war, the failure rate in a particular flight training program was unacceptably high. To overcome this problem, psychologists examined the general intellectual, psychomotor, and perceptual skills of individuals who were able to successfully perform the skills taught in the program, and then developed tests that measured these traits. These tests were used to screen candidates for the program, with those individuals who scored poorly being directed into other programs. As a result of using this examination of entry skills as a screening device, the military was able to significantly increase the percentage of personnel who successfully completed the program (Gagné, personal communication, 1985).

Immediately after the war, many of the psychologists responsible for the success of World War II military training programs continued to work on solving instructional problems. Organizations such as the American Institutes for Research were established for this purpose. During the late 1940s and throughout the 1950s, psychologists working for such organizations started viewing training as a system, and developed a number of innovative analysis, design, and evaluation procedures (Dick, 1987). For example, during this period, a detailed task analysis methodology was developed by Robert B. Miller while he worked on projects for the military (Miller, 1953, 1962). His work and those of other early pioneers in the instructional design field are summarized in *Psychological Principles in System Development*, edited by Gagné (1962b).

More Early Developments: The Programmed Instruction Movement

The programmed instruction movement, which ran from the mid-1950s through the mid-1960s, proved to be another major factor in the development of the systems approach. In 1954, B. F. Skinner's article entitled "The Science of Learning and the Art of Teaching" began what might be called a minor revolution in the field of education. In this article and later ones (e.g., Skinner, 1958), Skinner described his ideas regarding the requirements for increasing human learning and the desired characteristics of effective instructional materials. Skinner stated that such materials, called programmed instructional materials, should present instruction in small steps, require active

responses to frequent questions, provide immediate feedback, and allow for learner self-pacing. Moreover, because each step was small, it was thought that learners would answer all questions correctly and thus be positively reinforced by the feedback they received.

The process Skinner and others (cf. Lumsdaine & Glaser, 1960) described for developing programmed instruction exemplified an empirical approach to solving educational problems: data regarding the effectiveness of the materials were collected, instructional weaknesses were identified, and the materials were revised accordingly. In addition to this trial and revision procedure, which today would be called formative evaluation, the process for developing programmed materials involved many of the steps found in current instructional design models. As Heinich (1970) indicates:

> Programmed instruction has been credited by some with introducing the systems approach to education. By analyzing and breaking down content into specific behavioral objectives, devising the necessary steps to achieve the objectives, setting up procedures to try out and revise the steps, and validating the program against attainment of the objectives, programmed instruction succeeded in creating a small but effective self-instructional system—a technology of instruction. (p. 123)

The Popularization of Behavioral Objectives

As indicated above, those involved in designing programmed instructional materials often began by identifying the specific objectives learners who used the materials would be expected to attain. In the early 1960s, Robert Mager, recognizing the need to teach educators how to write objectives, wrote *Preparing Objectives for Programmed Instruction* (1962). This small, humorously written programmed book, now in its third edition (Mager, 1997), has proved to be very popular, and has sold over 1.5 million copies. The book describes how to write objectives that include a description of desired learner behaviors, the conditions under which the behaviors are to be performed, and the standards (criteria) by which the behaviors are to be judged. Many current day adherents of the instructional design process advocate the preparation of objectives that contain these three elements.

Although Mager popularized the use of objectives, the concept was discussed and used by educators at least as far back at the early 1900s. Among those early advocates of the use of clearly stated objectives were Bobbitt, Charters, and Burk (Gagné, 1965a). However, Ralph Tyler has often been considered the father of the behavioral objectives movement. In 1934, he wrote, "Each objective must be defined in terms which clarify the kind of behavior which the course should help to develop" (cited in Walbesser & Eisenberg, 1972). During the famous Eight-Year Study that Tyler directed, it was found that in those instances in which schools did specify objectives, those objectives were usually quite vague. By the end of the project, however, it was demonstrated that objectives could be clarified by stating them in behavioral terms, and those objectives could serve as the basis for evaluating the effectiveness of instruction (Borich, 1980; Tyler, 1975a).

In the 1950s, behavioral objectives were given another boost when Benjamin Bloom and his colleagues published the *Taxonomy of Educational Objec*tives (1956). The authors of this work indicated that within the cognitive domain there were various types of learning outcomes, that objectives could be classified according to the type of learner behavior described therein, and that there was a hierarchical relationship among the various types of outcomes. Moreover, they indicated that tests should be designed to measure each of these types of outcomes. As we shall see in the next two sections of this chapter, similar notions described by other educators had significant implications for the systematic design of instruction.

The Criterion-Referenced Testing Movement

In the early 1960s, another important factor in the development of the instructional design process was the emergence of criterion-referenced testing. Until that time, most tests, called norm-referenced tests, were designed to spread out the performance of learners, resulting in some students doing well on a test and others doing poorly. In contrast, a criterion-referenced test is intended to measure how well an individual can perform a particular behavior or set of behaviors, irrespective of how well others perform. As early as 1932, Tyler had indicated that tests could be used for such purposes (Dale, 1967). And later, Flanagan (1951) and Ebel (1962) discussed the differences between such tests and the more familiar norm-referenced measures. However, Robert Glaser (1963; Glaser & Klaus, 1962) was the first to use the term "criterion-referenced measures." In discussing such measures, Glaser (1963) indicated that they could be used to assess student entry-level behavior and to determine the extent to which students had acquired the behaviors an instructional program was designed to teach. The use of criterion-referenced tests for these two purposes is a central feature of instructional design procedures.

Robert M. Gagné: Domains of Learning, Events of Instruction, and Hierarchical Analysis

Another important event in the history of instructional design occurred in 1965, with the publication of the first edition of *The Conditions of Learning*, written by Robert

Gagné (1965b). In this book, Gagné described five domains, or types, of learning outcomes—verbal information, intellectual skills, psychomotor skills, attitudes, and cognitive strategies—each of which required a different set of conditions to promote learning. Gagné also provided detailed descriptions of these conditions for each type of learning outcome.

In the same volume, Gagné also described nine *events of instruction*, or teaching activities, that he considered essential for promoting the attainment of any type of learning outcome. Gagné also described which instructional events were particularly crucial for which type of outcome, and discussed the circumstances under which particular events could be excluded. Now in its fourth edition (Gagné, 1985), Gagné's description of the various types of learning outcomes and the events of instruction remain cornerstones of instructional design practices.

Gagné's work in the area of learning hierarchies and hierarchical analysis also has had a significant impact on the instructional design field. In the early 1960s and later in his career (e.g., Gagné, 1962a, 1985; Gagné, Briggs, & Wager, 1992; Gagné & Medsker, 1996), Gagné indicated that skills within the intellectual skills domain have a hierarchical relationship to each other, so that to readily learn to perform a superordinate skill, one would first have to master the skills subordinate to it. This concept leads to the important notion that instruction should be designed so as to ensure that learners acquire subordinate skills before they attempt to acquire superordinate ones. Gagné went on to describe a hierarchical analysis process (also called learning task analysis or instructional task analysis) for identifying subordinate skills. This process remains a key feature in many instructional design models.

Sputnik: The Indirect Launching of Formative Evaluation

In 1957, when the Soviet Union launched Sputnik, the first orbiting space satellite, there began a series of events that would eventually have a major impact on the instructional design process. In response to the launching of Sputnik, the U.S. government, shocked by the success of the Soviet effort, poured millions of dollars into improving math and science education in the United States. The instructional materials developed with these funds were usually written by subject matter experts and produced without tryouts with learners. Years later, in the mid-1960s, when it was discovered that many of these materials were not particularly effective, Michael Scriven (1967) pointed to the need to try out drafts of instructional materials with learners prior to the time the materials were in their final form. This process would enable educators to examine the materials and, if necessary, revise them while the materials were still in their formative stages. Scriven coined this tryout and revision process *formative evaluation*, and contrasted it with what he labeled *summative evaluation*, the testing of instructional materials after they are in their final form.

Although the terms formative and summative evaluation were coined by Scriven, the distinction between these two approaches was previously made by Lee Cronbach (1963). Moreover, during the 1940s and the 1950s, a number of educators, such as Arthur Lumsdaine, Mark May, and C. R. Carpenter, described procedures for evaluating instructional materials that were still in their formative stages (Cambre, 1981). However, in spite of the writings of such educators, very few of the instructional products developed in the 1940s and 1950s went through any sort of formative evaluation process. This situation changed somewhat in the late 1950s and through the 1960s, as many of the programmed instructional materials developed during that period were tested while they were being developed. However, authors such as Susan Markle (1967) decried a lack of rigor in testing processes. In light of this problem, Markle prescribed detailed procedures for evaluating materials both during and after the design process. These procedures are much like the formative and summative evaluation techniques generally prescribed today.

Early Instructional Design Models

In early and mid-1960s, the concepts that were being developed in such areas as task analysis, objective specification, and criterion-referenced testing were linked together to form a process, or model, for systematically designing instructional materials. Among the first individuals to describe such models were Gagné (1962b), Glaser (1962, 1965), and Silvern (1964). These individuals used terms such as "instructional design," "system development," "systematic instruction," and "instructional system" to describe the models they created. Other instructional design models created and employed during this decade included those described by Banathy (1968), Barson (1967), and Hamerus (1968).

The 1970s: Burgeoning of Interest in the Systems Approach

During the 1970s, the number of instructional design models greatly increased. Building upon the works of those who preceded them, many individuals created new models for systematically designing instruction (e.g., Dick & Carey, 1978; Gagné & Briggs, 1974; Gerlach & Ely, 1971; Kemp, 1971), several of which became "standards" in the field. Indeed, updated versions of at least two of these models (Dick, Carey, & Carey, 2009; Morrison, Ross, Kemp, & Kalman 2010) are still frequently taught to

graduate students studying instructional design (Reiser, Mackal, & Sachs, 2005).

During the 1970s, interest in the instructional design process flourished in a variety of different sectors. In 1975, several branches of the U.S. military adopted an instructional design model (Branson et al., 1975) intended to guide the development of training materials within those branches. In academia, during the first half of the decade, many instructional improvement centers were created with the intent of helping faculty use media and instructional design procedures to improve the quality of their instruction (Gaff, 1975; Gustafson & Bratton, 1984). Moreover, many graduate programs in instructional design were created (Partridge & Tennyson, 1979; Redfield & Dick, 1984; Silber, 1982). In business and industry, many organizations, seeing the value of using instructional design to improve the quality of training, began adopting the approach (cf. Mager, 1977; Miles, 1983). Internationally, many nations, such as South Korea, Liberia, and Indonesia, saw the benefits of using instructional design to solve instructional problems in those countries (Chadwick, 1986; Morgan, 1989). These nations supported the design of new instructional programs, created organizations to support the use of instructional design, and provided support to individuals desiring training in this field. Many of these developments were chronicled in the *Journal of Instructional Development*, a journal that was first published during the 1970s.

The 1980s: Growth and Redirection

In many sectors, the interest in instructional design that burgeoned during the previous decade continued to grow during the 1980s. Interest in the instructional design process remained strong in business and industry (Bowsher, 1989; Galagan, 1989) the military (Chevalier, 1990; Finch, 1987; McCombs, 1986;) and in the international arena (Ely & Plomp, 1986: Morgan, 1989).

In contrast to its influence in the aforementioned sectors, during the 1980s, instructional design had minimal impact in other areas. In the public school arena, some curriculum development efforts involved the use of basic instructional design processes (e.g., Spady, 1988), and some instructional design textbooks for teachers were produced (e.g., Dick & Reiser, 1989; Gerlach & Ely, 1980; Sullivan & Higgins, 1983). However, in spite of these efforts, evidence indicated that instructional design was having little impact on instruction in the public schools (Branson & Grow, 1987; Burkman, 1987b; Rossett & Garbosky, 1987). In a similar vein, with a few exceptions (e.g., Diamond, 1989), instructional design practices had a minimal impact in higher education. Whereas instructional improvement centers in higher education were growing in number through the mid-1970s, by 1983 more than one-fourth of these organizations were disbanded and there was a general downward trend in the budgets of the remaining centers (Gustafson & Bratton, 1984). Burkman (1987a, 1987b) provides an enlightening analysis of the reasons why instructional design efforts in schools and universities have not been successful, and contrasts these conditions with the more favorable conditions that exist in business and the military.

During the 1980s, there was a growing interest in how the principles of cognitive psychology could be applied in the instructional design process, and a number of publications outlining potential applications were described (e.g., Bonner, 1988; Divesta & Rieber, 1987; "Interview with Robert M. Gagné," 1982; Low, 1980). However, several leading figures in the field have indicated that the actual effects of cognitive psychology on instructional design practices during this decade were rather small (Dick, 1987; Gustafson, 1993).

A factor that did have a major effect on instructional design practices in the 1980s was the increasing interest in the use of personal computers for instructional purposes. With the advent of these devices, many professionals in the instructional design field turned their attention to producing computer-based instruction (Dick, 1987; Shrock, 1995). Others discussed the need to develop new models of instructional design to accommodate the interactive capabilities of this technology (Merrill, Li, & Jones, 1990a, 1990b). Moreover, computers began to be used as tools to automate some instructional design tasks (Merrill & Li, 1989).

The 1990s: Recognizing the Importance of Performance

Beginning in the 1990s and continuing on into the current century, one of the trends that has had a major impact on the field has been the human performance improvement movement (see Section 4 of this book). This movement, with its emphasis on on-the-job performance (rather than learning), business results, and non-instructional solutions to performance problems, has broadened the scope of the instructional design field.

During the 1990s, another factor that began to have a major influence on the field was the growing interest in constructivist views of teaching and learning. For example, the constructivist emphasis on designing "authentic" learning tasks—tasks that reflect the complexity of the real world environment in which learners will be using the skills they are learning—has had an effect on how instructional design is being practiced and taught.

During the 1990s, instructional designers also began to have an interest in using computers not only as an

instructional tool to enhance learning, but also as an aid to improve on-the-job performance. In particular, it was during this decade that an interest in using electronic performance support tools and systems to support on-the-job performance began to flourish. In addition, during this decade instructional designers began to discuss the use of computer-based knowledge management systems to support learning and performance (viz., Schwen, Kalman, Hara & Kisling, 1998).

Into the Twenty-First Century: e-Learning and Informal Learning

During the first decade of the twenty-first century, several developments have had a major influence on the field of instructional design. One such development involves the increasing use of the Internet as a means of presenting instruction to learners. As noted in an earlier section of this chapter, during this decade there has been significant growth in online learning in business and industry and the military, as well as K–12 and higher education. Along with this growth has come the realization that instructional designers play a vital part in the creation of online courses. This realization has opened new job opportunities for those in the instructional design field and has also presented new challenges as instructional design professionals attempt to identify interesting and effective means of delivering instruction online.

Another recent development that has had a major impact on the instructional design field has been the increasing reliance on informal methods, as opposed to formal training, as a means of improving learning and performance in the workplace. For example, in 2008, 75 percent of employees in business and industry reported that they used knowledge bases to help them learn and perform their jobs, 74 percent reported using performance support tools, and 67 percent reported using online communities of practice (American Society for Training and Development, 2009). Moreover, as discussed earlier, the increasing use of social media to share knowledge and skills serves as another example of the burgeoning reliance on the use of informal methods to improve learning and performance. As interest in using these informal mechanisms increases, it is likely that many instructional designers will have to learn how to design, implement, and support these alternate means of acquiring knowledge and skills.

Conclusion

Although this chapter has provided separate accounts of the history of instructional media and the history of instructional design, there is an obvious overlapping between these two areas. Many instructional solutions arrived at through the use of instructional design processes require the employment of the instructional media discussed in the first half of this chapter. Moreover, many individuals (e.g., Clark, 2001; Clark, 1994; Kozma, 1994; Morrison, 1994; Reiser, 1994; Shrock, 1994) have argued that the effective use of media for instructional purposes requires careful instructional planning, such as that prescribed by models of instructional design. In the field of instructional design and technology, those whose work is influenced by the lessons learned from the history of media *and* the history of instructional design will be well-positioned to have a positive influence on future developments within the field.

Summary of Key Principles

1. Throughout most of the 1900s, as each new medium (i.e., films, radio, and television) entered the world of education, there was a great deal of optimism regarding the extent to which that medium would change instructional practices. However, contrary to expectations, none of the aforementioned media had nearly the effect that the optimists envisioned.
2. The likely reasons as to why each medium had minimal effects on practice are many. Those that are frequently cited include teacher resistance to change, especially *top-down change*, the costs associated with purchasing and maintaining the necessary media hardware, the poor instructional quality of media software, and failure to provide teachers with adequate guidance as to how to integrate the new media into their instructional practices.
3. In recent years, computers and related technologies have had a greater effect on instructional practices and learning than did the various media that preceded them. The interactive capabilities of these media, their ability to present information and instruction in a wide variety of forms, and the ease with which learners can create and share their own knowledge and skills via these media appear to be some of the primary reasons why these media have had a greater influence on instruction and learning.
4. Portions of most of the instructional design models that were created in the 1960s and 1970s, and which still remain popular today, can be traced back to developments in education and training during the 1940s through the 1960s. Advances in military training during World War II, new

directions in instruction emanating from the programmed instruction movement, and new ideas involving behavioral objectives, criterion-referenced testing, learning hierarchies, and formative evaluation are often reflected in the various steps in these models.

5. In the 1980s and 1990s, many instructional design models and practices were influenced by the principles derived from cognitive psychology and the new views of teaching and learning associated with constructivism. Moreover, during that period the performance improvement movement led many instructional designers to begin thinking about the importance of positively influencing on-the-job performance, and identifying non-instructional, as well as instructional, means of doing so.
6. During the first decade of the twenty-first century, the increasing interest in e-learning has opened new opportunities for instructional designers. At the same time, the burgeoning use of informal methods of acquiring knowledge and skills is likely to result in many instructional designers learning how to design, implement and support informal learning opportunities.

Application Questions

1. During the previous school year, all the students assigned to four subject area teachers (math, language arts, social studies, and science) in the seventh grade at a local middle school were given laptop computers and provided with wireless Internet access at home and in school for an entire year. The students took the laptops home every evening and brought them into classes every day. Teachers were also provided with laptops and wireless Internet access 24/7 (24 hours a day, every day of the week) for the entire year. Moreover, all of the curriculum materials (textbooks, workbooks, student study guides, teacher curriculum guides, etc.) that the teachers normally used during the school year were installed on the laptops.

   Assume that you were assigned as one of the evaluators for the project described above and that throughout the year you examined how this innovation (providing teachers and students with 24/7 access to laptops, curriculum materials, and wireless Internet service) changed the way instruction was presented in the classrooms of the four teachers who were involved in the project. Further assume that your findings clearly indicated that the innovation had very little effect on the manner in which instruction was presented in the teachers' classrooms. Now do the following:

   a. Describe at least three possible reasons (factors) why the project described above had very little effect on the instructional practices employed by the teachers. Each of the factors you identify should be related to the factors mentioned in this chapter as to why earlier forms of instructional media (i.e., films, radio, and televison) had very limited effects on instructional practices.
   b. Describe at least two strategies that could have been employed to help mitigate the factors that you think contributed to the minimal effect this project had on instructional practices. Indicate why you think each of these strategies might have been helpful.

2. Congratulations! Your instructional design consulting company has just been selected as one of the finalists to receive a contract to design a print-based instructional unit that will teach sixth-grade students throughout the United States how to multiply fractions. Now, to receive the contract, the contracting agency has asked you to prepare a memo in which you describe why your company is well-suited to take on this task. However, as noted below, this memo isn't your normal memo!

   The agency's chief contract officer feels that the contract should be awarded to someone who understands the history of instructional design and can apply the ideas from that history to today's instructional design tasks. Therefore, he has asked that each of the finalists send him a 250- to 300-word memo in which they select *four* of the six historical periods listed below, and briefly describe how an instructional design principle derived from that period might be used in the design and/or presentation of the instructional unit on fractions. Write the memo!

   Historical periods:
   - World War II
   - Programmed instruction movement
   - Behavioral objectives movement
   - Criterion-referenced testing movement
   - Early work of Robert M. Gagne
   - Formative evaluation movement

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